SPECIFICATION

[Title of the Invention]

METHOD OF AND APPARATUS FOR REPRODUCING AV DATA IN INTERACTIVE MODE, AND INFORMATION STORAGE MEDIUM THEREFOR

[Brief Description of the Drawings]

FIG. 1 is a diagram of the physical structure of a track of a conventional interactive DVD.

FIGS. 2A and 2B are reference diagrams for explaining a break that can occur in a process of reproducing the interactive DVD of FIG. 1.

FIG. 3 is a diagram of a recording and/or reproducing system according to an embodiment of the present invention.

FIG. 4 is a block diagram of a reading and/or reproducing apparatus according to an embodiment of the present invention.

FIG. 5 is a diagram showing an embodiment of an ENAV buffer of FIG. 4 and the relation between the ENAV buffer and an EVAV buffer manager.

FIGS. 6A through 6D are reference diagrams showing a buffer control method according to an embodiment of the present invention.

FIG. 7 is an example of link information for controlling the buffer of FIGS. 6A through 6D according to an embodiment of the present invention.

FIG. 8 is an example of synchronization information for controlling the buffer of FIGS. 6A through 6D.

FIG. 9 is a reference diagram showing the buffer control of FIGS. 6A through 6D according to an embodiment of the present invention.

FIG. 10 is a reference diagram showing the buffer control of FIGS. 6A through 6D according to an embodiment of the present invention.

[Detailed Description of the Invention]

[Object of the Invention]

[Technical Field of the Invention and Related Art Prior to the Invention]

The present invention relates to a method for reproducing audio/video (AV) data in an interactive mode, and more particularly, to a method and apparatus for seamlessly reproducing AV data by appropriately buffering interactive data for reproducing the AV data in the interactive mode, and an information storage medium therefor.

Interactive DVDs that can be reproduced in a personal computer (PC) are on the market. An interactive DVD means a DVD in which interactive data, for example, markup documents, are recoded in addition to recorded DVD-Video data. Interactive DVDs can be reproduced in either of two modes. One mode is a video mode in which only the DVD-Video data is reproduced as with an ordinary DVD. The other mode is an interactive mode in which the DVD-Video data is reproduced together with a markup document and is displayed through a display window of the markup document. If the interactive mode is selected by a user, a web browser embedded in the PC parses and displays a markup document recorded on the interactive DVD. The DVD-Video data selected by the user is displayed in the display window defined by the markup document.

For example, if the DVD-Video data is a film, the film is reproduced in the display window of the markup document. In the remaining part of the display window, the script, synopsis, photos of actors, and other related additional information related to the film can be displayed. Additional information includes image files and/or text files.

FIG. 1 is a diagram of the physical structure of a track of a conventional interactive DVD. Referring to FIG. 1, in the track of the interactive DVD, DVD-Video data (i.e., AV data) is recorded as MPEG bitstreams. Interactive data, including a plurality of markup documents or markup resources containing a variety of image files and graphic files that are embedded into markup documents, is further recorded.

FIGS. 2A and 2B are reference diagrams for explaining a break that can occur in a reproducing process of the interactive DVD of FIG. 1. Referring to FIGS. 2A and 2B, the state of an AV buffer in which DVD-Video data is buffered, and the state of an

interactive buffer in which interactive data is buffered are shown. Referring to FIGS. 1 through 2B, a process of AV data being buffered in the buffer and then displayed will now be explained. A pickup apparatus searches for and reads STARTUP.HTM and buffers the file in the buffer. The loaded STARTUP.HTM is activated. At the same time, (1) AV data selected by a user is buffered and then displaying of (1) AV data begins. Then, (2) AV data is buffered and displaying of (2) AV data begins. If buffering of (2) AV data finishes, the pickup apparatus jumps to a location in which (3) AV data is recorded and begins buffering. If the user requests (4) A.HTM, the pickup apparatus stops buffering the (3) AV data and searches for (4) A.HTM and buffers the data in the (4) A.HTM. During this time, (3) AV data is continuously displayed and accordingly, the amount of data that can be buffered and displayed rapidly decreases. After (4) A.HTM is activated and buffering of the (3) AV data finishes, (5) AV data is buffered. If buffering of (5) AV data finishes, the pickup apparatus jumps to a location in which (6) AV data is recorded. In this case, data being buffered may be exhausted. That is, in the conventional interactive DVD, when a DVD-Video screen and a markup screen should be synchronized with each other before being displayed (for example, a case in which when a predetermined actor appears, a profile of the actor is displayed), the pickup apparatus has to stop buffering AV data and search for and read a markup document corresponding a DVD-Video screen, and buffer the markup document. Accordingly, a break in displaying DVD-Video scenes may occur as shown in FIG. 2A.

[Technical Goal of the Invention]

The present invention provides a method and apparatus that reproduces audio/video (AV) data in an interactive mode and smoothly buffers the interactive data so that a break during reproduction of AV data does not occur, and an information storage medium therefor.

[Structure of the Invention]

According to an aspect of the present invention, there is provided an information storage medium useable by a recording and/or reproducing apparatus, the medium comprising audio/video (AV) data; and interactive data for reproducing the AV data in an interactive mode, wherein the interactive data comprises a plurality of ENAV units which are smaller than a predetermined size.

The interactive data may include link information between the AV data and the ENAV units, which is described by using a structure of the AV data.

The interactive data may include link information between the AV data and the corresponding ENAV units, which is described using reproduction time information of the AV data.

Each of the ENAV units may comprise at least one ENAV page containing synchronization information indicating a time at which to display the ENAV page.

The interactive data may comprise markup documents and markup resources linked to the markup documents, wherein one of the markup documents includes a startup file that contains the link information, and each of the markup documents corresponding to the ENAV pages comprises the synchronization information.

The AV data may comprise DVD-Video data, and the link information and the synchronization information may be described using a presentation time stamp of the DVD-Video data.

According to another aspect of the present invention, there is provided an information storage medium comprising audio/video (AV) data; and interactive data for reproducing the AV data in an interactive mode, wherein the interactive data comprises a plurality of ENAV units smaller than a predetermined size, and a starting page of each of the ENAV units is stored with a predetermined start file name.

Each of the ENAV units may comprise at least one ENAV page, and the start page may be one of the ENAV pages.

According to another aspect of the present invention, there is provided an information storage medium comprising audio/video (AV) data; and interactive data for reproducing the AV data in an interactive mode, wherein the interactive data comprises at least one ENAV page, and the ENAV page comprises control command information regarding an ENAV buffer for buffering the ENAV page.

The control command information may command data stored in the ENAV buffer to be discarded.

The interactive data may be divided into a plurality of ENAV units containing the ENAV page. The control command information may command an ENAV unit stored in the ENAV buffer to be discarded and a next ENAV unit to be read into the ENAV buffer.

According to another aspect of the present invention, there is provided an apparatus for reproducing audio/video (AV) data in an interactive mode, the apparatus comprising an ENAV buffer buffering interactive data for reproducing the AV data in the interactive mode, where the interactive data is divided into a plurality of ENAV units smaller than a predetermined size; and an ENAV buffer manager controlling the ENAV buffer to so that the interactive data are read into and discarded from the ENAV buffer in units of the EVAV units.

The ENAV buffer manager may control the ENAV buffer to read the ENAV units before the AV data is displayed, based on link information between the AV data and the ENAV units, which is described using a structure of the AV data. The ENAV buffer manager may control the ENAV buffer to read the ENAV units before the AV data is displayed, based on link information between the AV data and the ENAV units, which is described using reproduction time information of the AV data. The ENAV buffer manager may control the ENAV buffer to read a corresponding ENAV unit, based on synchronization information recorded in markup documents corresponding to ENAV pages. The ENAV buffer manager may control the ENAV buffer to read a corresponding ENAV unit, based on the synchronization information and link information between the AV data and the ENAV unit.

According to another aspect of the present invention, there is provided an apparatus for reproducing audio/video (AV) data in an interactive mode, the apparatus comprising an ENAV buffer buffering interactive data for reproducing the AV data in the interactive mode, where the interactive data is divided into a plurality of ENAV units smaller than a predetermined size; and an ENAV buffer manager controlling the ENAV buffer so that, if a start page having a predetermined file name is found in the interactive data, an ENAV unit corresponding to the start page is read into the ENAV buffer.

At least one of the ENAV units may comprise at least one ENAV page, and the start page may be one of the ENAV pages.

According to another aspect of the present invention, there is provided a method of reproducing audio/video (AV) data in an interactive mode, the method comprising (a) buffering interactive data for reproducing the AV data in the interactive mode, where the buffering comprises reading and discarding the AV data in units of ENAV units smaller than a predetermined size; and (b) reproducing the AV data in the interactive mode by using the buffered interactive data.

(a) may comprise reading the ENAV units before the AV data is displayed, based on link information between the AV data and the ENAV units, which is described using a structure of the AV data. (a) may comprise reading the ENAV units before the AV data is displayed, based on link information between the AV data and the ENAV units, which is described using reproduction time information of the AV data. (a) may comprise reading a corresponding ENAV unit, based on synchronization information recorded in markup documents corresponding to ENAV pages.

Reference will now be made in detail to the embodiments of the present invention, examples of which are illustrated in the accompanying drawings, wherein like reference numerals refer to the like elements throughout. The embodiments are described below to explain the present invention by referring to the figures.

In the present invention, interactive data indicates data that are needed in reproducing audio/video (AV) data in an interactive mode. The interactive mode indicates a mode in which not only an AV screen obtained from AV data is displayed, but

also a screen in which is displayed additional information or through which interaction with a user is enabled. For example, the interactive data indicates not only markup documents, but also markup resources containing files that are embedded into or linked to a markup document. In addition to HTML, '~.HTM' also represents documents written in markup languages such as XML and SGML that are displayed in the interactive mode. Moreover, it is understood that other languages can be implicated, such as Javascript, and other applications can be implemented using the language, such as through applets.

FIG. 3 is a diagram of a recording and/or reproducing system according to an embodiment of the present invention. Referring to FIG. 3, the recording and/or reproducing system comprises a DVD 300, which is an information storage medium according to an embodiment of the present invention, a recording and/or reproducing apparatus 200, a TV 100 as a display apparatus according to an aspect of the present embodiment, and a remote controller 400 as a user input apparatus. It is understood that the TV 100 could instead be another type of display unit, such as LCD or PDP displays, a flat panel display, or other types of display units through which visual images are displayed. It is further understood that the user input apparatus could include a keyboard or other computer input device, such as a stylus or touch screen, instead of or in addition to the remote controller 400. Lastly, it is also understood that the information storage medium could be other than a DVD, such as next generation DVD including Blu-ray discs or Advanced Optical Discs (AODs), a CD, magnetic media, and that the information storage medium could be writable as well as read only.

According to an embodiment of the invention, the DVD 300 includes DVD-Video data including AV data and interactive data for reproducing the DVD-Video data in an interactive mode. In the present embodiment, the interactive data is implemented as markup documents written in markup languages, and markup resources linked to the markup documents. According to an aspect of the invention, the interactive data is divided into a plurality of ENAV units, each of which is equal to or less than a predetermined size. However, it is understood that the plurality of ENAV units could

also be of other sizes.

An ENAV unit is a unit for buffering according to an aspect of the present invention. That is, an ENAV unit is one of a plurality of units obtained by dividing the interactive data into separate units which are equal to or less than a predetermined size in order to buffer the interactive data. The ENAV unit contains at least one ENAV page. The ENAV page may be implemented as a markup document, or a markup document and at least one markup resource linked to the markup document. Specifically, in terms of what is displayed, the ENAV page indicates a set of data used to display an interactive screen in which a markup document and markup resources linked to the markup document (such as an image, animation, asynchronous audio data, and moving pictures) are all embedded and displayed. However, it is understood that the markup document need not display data beyond defining an AV screen size or location. More detailed data structures of the DVD 300 will be explained later referring to each embodiment.

According to an aspect of the invention, the remote controller 400 receives a control command from the user and transmits the command to the recording and/or reproducing apparatus 200. The recording and/or reproducing apparatus 200 has a DVD drive for reading data recorded on the DVD 300. If the DVD 300 is placed on the DVD drive and the user selects the interactive mode, the recording and/or reproducing apparatus 200 buffers the interactive data in units of ENAV units in a predetermined order. Using the buffered interactive data, the recording and/or reproducing apparatus 200 reproduces the corresponding AV data in the interactive mode and transmits the data to the TV 100. On the TV 100, an interactive screen and an AV screen embedded in the interactive screen obtained from the interactive data are displayed together.

The interactive mode means a mode in which AV data is displayed together with interactive data. That is, in the present embodiment, the AV data is displayed in a display window defined in a markup document such that an AV screen is displayed embedded in an interactive screen. Here, the AV screen indicates a screen displayed on the display apparatus by reproducing AV data, and the interactive screen indicates a

screen displayed on the display apparatus after the markup document and markup resources are parsed. Meanwhile, the video mode is a mode in which AV data is reproduced in the same manner as defined in the conventional DVD-Video. That is, only an AV screen obtained by reproducing corresponding AV data is displayed. In an aspect of the present embodiment, the reproducing and/or recording apparatus 200 supports both interactive mode and video mode. In addition, the reproducing and/or recording apparatus 200 can access the Internet and transmit data separately or according to the ENAV units of the DVD 300.

FIG. 4 is a block diagram of a recording and/or reproducing apparatus according to an embodiment of the present invention. Referring to FIG. 4, the recording and/or reproducing apparatus is an apparatus which supports the interactive mode in which an AV stream, the AV stream is obtained by decoding the AV data recorded on the DVD 300 and, is output through a display window defined by a markup document. The recording and/or reproducing apparatus comprises a reader 2, an AV buffer 3, an ENAV buffer 4, an AV reproducing engine 5, a presentation engine 6 and a blender 7. An ENAV buffer manager 61 is installed in the presentation engine 6. For the sake of simplicity, only reproducing aspects of the recording and/or reproducing apparatus shown in FIG. 3 will be referred to below. However, it is understood that a recording operation could be performed using the apparatus to create the DVD 300 using the recording and/or reproducing apparatus shown in FIGS. 3 and 4.

The reader 2 reads the AV data and the interactive data recorded on the DVD 300. The ENAV buffer 4 is logically or physically divided into a plurality of parts so that the ENAV buffer 4 can buffer interactive data in units of ENAV units, which are equal to or less than a predetermined size. Buffering data in units of ENAV units means that interactive data is read and discarded in units of ENAV units. One of the reasons why the ENAV buffer 4 is divided into at least two parts is to enable a read operation for reading interactive data in units of ENAV units into part of the ENAV buffer 4 and at least part of a discard operation for discarding data stored in the other part to be carried out at the same time. Another reason is to avoid the difficulties of dynamic buffer

management for a single part buffer, in which part of data already stored in the buffer should be discarded in order to buffer new data, and to manage the buffer more conveniently and efficiently.

The presentation engine 6 is an interpretation engine which parses markup languages and client parsing program languages, for example, JavaScript and Java. In addition, the presentation engine 6 has a decoder for decoding markup resources such that markup files having a variety of formats can be opened. In the interactive mode, the presentation engine 6 fetches a markup document (and markup resources) from the ENAV buffer 4, parses the fetched document, and confirms the location of a display window in which the AV data stream output from the reproducing engine 5 is to be displayed. The presentation engine 6 also detects that portion of the AV data being reproduced by the AV reproduction engine 5. The blender 7 blends the AV data stream with the display window so that the AV data stream is displayed in the display window defined by the markup document (i.e., the AV screen is embedded in the interactive screen). Then, the blender 7 outputs the result to the TV 100.

In particular, according to an aspect of the present invention, before the AV data corresponding to ENAV units is displayed on the display apparatus 100, the ENAV buffer manager 61 controls the ENAV buffer 4 so that, for example, predetermined ENAV units are read in a predetermined order. As another example, the ENAV buffer manager 61 controls the ENAV buffer 4 so that, before the AV data is displayed on the display apparatus 100, the ENAV units corresponding to the AV data is read by referring to link information described by using the DVD-Video data structure. As still another example, the ENAV buffer manager 61 controls the ENAV buffer 61 so that, before the AV data is displayed on the display apparatus 100, the ENAV units corresponding to the AV data is read by referring to link information described by using reproducing time information of the AV data. According to an aspect of the invention, the ENAV buffer manager 61 detects that portion of the AV data being reproduced in the AV reproduction engine 5. Thus, the ENAV buffer manager 61 buffers the required interactive data before the AV data is displayed on the display apparatus 100 such that the ENAV buffer

manager 61 can prevent a break in displaying the AV data, which occurs when buffering of AV data stops in order to read interactive data which should be displayed together with corresponding AV data.

FIG. 5 is a diagram showing an embodiment of the ENAV buffer 4 of FIG. 4 and the relation between the ENAV buffer 4 and the EVAV buffer manager 61. Referring to FIG. 5, the ENAV buffer 4 comprises an audio buffer 41, an ENAV-unit buffer 42, and a font buffer 43. The audio buffer 41 buffers audio data that are reproduced in synchronization with the AV data. For example, the audio data might be a speech (audio data) or commentary of a producer of a film (AV data). The font buffer 43 buffers font data to be used in rendering text included in a markup document.

The ENAV-unit buffer 42 buffers ENAV pages in units of ENAV units. An ENAV unit is a set of data which should be read in at the same time in order to reproduce the AV data seamlessly, and contains at least one ENAV page. If the size of the ENAV-unit buffer 42 is generally greater than the size of interactive data recorded on the DVD 300, there is no special need to manage the buffering of interactive data because all the interactive data can be read before reproduction of the AV data begins. However, the greater the size of the buffer, the bigger the size of the entire system should be and the higher the price of the system. Accordingly, the ENAV-unit buffer 42 generally has a predetermined size less than the entire size of the interactive data according to an aspect of the invention. Particularly, the ENAV-unit buffer 42 according to the present embodiment is logically or physically divided into two parts, ENAV-unit buffer #1 421 and ENAV-unit buffer #2 422. However, it is understood that more ENAV-unit buffers can be used, that the division can be logical and/or physical, and that the size of the buffer can be larger than the interactive data according to other aspects of the invention.

In the present embodiment, when the AV data is reproduced, the ENAV buffer manager 61 senses a time when an ENAV unit corresponding to the AV data is to be replaced with another ENAV unit, empties either the ENAV-unit buffer #1 421 or the ENAV-unit buffer #2 422, and buffers the next ENAV unit in the emptied buffer. That is, while an ENAV unit stored in the ENAV-unit buffer #1 421 is read, another ENAV unit

stored in the ENAV-unit buffer #2 422 is discarded, and still another ENAV unit is read into the ENAV-unit buffer #2 422. Again, while the ENAV unit newly stored in the ENAV-unit buffer #2 422 is read, the ENAV unit stored in the ENAV-unit buffer #1 421 is discarded and then another ENAV unit is read into the ENAV-unit buffer #1 421.

FIGS. 6A through 6D show a buffer control method according to an embodiment of the present invention. Referring to FIGS. 6A through 6D, in the present embodiment, interactive data is divided into a plurality of ENAV units, #1, #2, #3, ..., and each of the ENAV units contains at least one ENAV page. Each ENAV page has a corresponding markup document index.htm.

At time A, the ENAV buffer manager 61 reads ENAV unit #1 into the ENAV-unit buffer #1 421. At time B, the ENAV buffer manager 61 reads ENAV unit #2 into the ENAV-unit buffer #2 422. Time A and time B may be determined in a variety of ways and time A does not necessarily precede time B. The ENAV buffer manager 61 senses the change of an ENAV unit at time C, and discards the ENAV unit #1 stored in the ENAV-unit buffer #1 421, and begins to read in ENAV unit #3 to the ENAV-unit buffer #1 421.

FIG. 7 is an example of link information for controlling the buffer of FIG. 6 according to an embodiment of the present invention. Referring to FIG. 7, a startup file startup.htm is not displayed on the display apparatus (i.e., the TV 100), but performs a function to provide a variety of parameter values such as a size of a screen, a color of a screen, etc. In the startup file, a box marked by dotted lines indicates link information according to the present embodiment. The link information is implemented as information obtained by mapping a presentation time stamp (PTS) that is the reproducing time information of the DVD-Video data corresponding to an ENAV unit. ENAV unit #1 corresponds to PTS 0-9999, ENAV unit #2 corresponds to PTS 10000-19999 of the DVD -Video, and ENAV unit #3 corresponds to PTS 2000-N of the DVD - Video. Accordingly, it is shown that ENAV unit #1(i.e., ENAV pages corresponding to PTS 0-9999) is first read into the ENAV-unit buffer # 1 421, and ENAV unit #2 (i.e., ENAV pages corresponding to PTS 10000-19999) is first read into the ENAV-unit buffer

2 422, and ENAV unit #3 (i.e., ENAV pages corresponding to PTS 20000-N) is read into the ENAV-unit buffer #1 421.

Thus, in the startup file startup.htm, link information on ENAV units #1, #2, and #3 of the DVD -Video, which are each smaller than the size of each unit of the ENAV-unit buffer 42, can be ordered all by using a PTS, which is reproducing time information of the DVD -Video.

FIG. 8 is an example of synchronization information for controlling the buffer of FIGS. 6A through 6D according to an embodiment of the present invention. Referring to FIG. 8, a box marked by dotted lines of index_unit2.htm indicates synchronization information according to an aspect of the present embodiment. If the start page index_unit2.htm of ENAV unit #2 is called by navigation of the user according to an arbitrary route, the presentation engine 6 parses index_unit2.htm and finds that synchronization information (i.e., a time when the document should be displayed) is PTS 10000 of the DVD -Video. That is, the presentation engine 6 realizes that ENAV unit #1 is changed by ENAV unit #2 through link information obtained from the startup file startup.htm as described above referring to FIG. 7. Then, the ENAV buffer manager 61 sends a control command that ENAV-unit buffer #1 421 which is storing ENAV unit #1 be emptied, and then a control command that ENAV unit #2 be read in to the ENAV-unit buffer #2 422. Then, if the start page index_unit3.htm of ENAV unit #3 is called after ENAV unit #2 has been completely reproduced, the presentation engine 6 parses the index_unit3.htm and realizes that synchronization information, (i.e., a time when the document should be displayed) is PTS 20000 of the DVD-Video, and that ENAV unit #2 is changed by ENAV unit #3, through link information obtained from the startup file startup.htm, as described above referring to FIG. 7. Then, the ENAV buffer manager 61 sends a control command that ENAV-unit buffer #2 422 that is storing ENAV unit #2 422 be emptied, and then a control command that ENAV unit #3 be read in to the ENAV-unit buffer #1 421.

The control command for emptying the buffer and the control command for reading the ENAV unit in may be indicated as 1) and 2) below, respectively according to

an aspect of the invention:

1) navigator.Discard("ENAV_Unit N")

2) navigator.Preload("ENAV_Unit N")

In the above control commands, "ENAV_Unit" may be a name indicating a set of included files or may be all included files.

FIG. 9 shows the buffer control method of FIG. 6 according to an embodiment of the present invention. Referring to FIG. 9, ENAV unit #2 corresponds to PTS 10000-19999 of the DVD -Video, and ENAV unit #3 corresponds to PTS 20000-N. ENAV unit #2 has at least one ENAV page, and the ENAV page comprises a start page 71 and any remaining ENAV pages 81. ENAV unit #3 also has at least one ENAV page, and the ENAV page comprises a start page 72 and any remaining ENAV pages 82.

The start page 71 of ENAV unit #2 has a predetermined proper name and start file name #2, and the start page 72 of ENAV unit #3 has a predetermined proper name and start file name #3. Accordingly, if a file having a predetermined proper name is called, the presentation engine 6 can realize that an ENAV unit change has been made. As an ENAV unit is changed, the ENAV buffer manager 61 can send a control command commanding that the ENAV-unit buffer #1 421 or the ENAV-unit buffer #2 422 be emptied and that a new ENAV unit be read in. If there are a plurality of start pages in an ENAV unit, only a start page which indicates that an ENAV change will occur is made to have a predetermined proper name.

FIG. 10 shows a buffer control method of FIGS. 6A through 6D according to an embodiment of the present invention. Referring to FIG. 10, ENAV unit #2 corresponds to PTS 10000-19999 of the DVD -Video and ENAV unit #3 corresponds to PTS 20000-N. ENAV unit #2 has markup documents index_unit2.htm, unit2_1.htm and unit2_2.htm corresponding to ENAV pages. ENAV unit #3 has markup documents index_unit3.htm, unit3_1.htm and unit3_2.htm corresponding to ENAV pages. Here, arrows comprised of solid lines indicate routes through which the user can navigate.

In the shown embodiment, the ENAV-unit buffer #1 421 or the ENAV-unit buffer #2 422 is practically managed by the intention of the producer. That is, the producer

inserts control command information for directly controlling the ENAV-unit buffer #1 421 or the ENAV-unit buffer #2 422, in all ENAV pages where an ENAV unit can be changed. For example, in the box marked by dotted lines in the ENAV page of ENAV unit #3 of FIG. 10, control command information for the ENAV-unit buffer #1 421 or the ENAV-unit buffer #2 422is recorded as follows:

navigator.Discard("ENAV_Unit_Buffer1")

The presentation engine 6 can realize the control command information only after parsing the called markup document, and based on the realized information, the ENAV buffer manager 61 sends a corresponding control command such that the ENAV-unit buffer 42 of FIG. 5 is controlled. In the present embodiment, the presentation engine 6 only needs to support control commands such as navigator.Discard("ENAV_Unit_Buffer1"). When interactive data is produced so that one ENAV unit is reproduced and then a navigation route is set to the next ENAV unit, the producer should insert control command information. By doing so, seamless reproduction can be guaranteed by emptying a buffer and reading a next ENAV unit into the buffer in advance before AV data corresponding to the ENAV data is reproduced.

As described above, according to the present invention, when AV data is reproduced in an interactive mode, interactive data is divided into a plurality of ENAV units and stored in advance. Then, when predetermined AV data is reproduced, a buffer is emptied when an ENAV is to be changed, and the ENAV unit to be changed is read in advance. In this manner, the buffer is managed such that seamless reproduction of AV data is guaranteed.

It is understood that, according to an aspect of the invention, the AV reproducing engine 5, the presentation Engine 6, and the ENAV buffer manager 61, and/or the blender 7 can be implemented as computer software encoded on a computer readable medium for controlling a general or special purpose computer. It is further understood that the DVD 300 can be recorded on a recordable DVD 300 so as to achieve the methods of FIGS. 6A through 10. Also, it is understood that other information media may be used instead of the DVD 300, such as CD, DVD-R, DVD-R/W, next generation

DVD such as Blu-Ray discs, Advanced Optical Discs, and discs utilizing WINDOWS MEDIA VIDEO, or magnetic media.

Although a few embodiments of the present invention have been shown and described, it would be appreciated by those skilled in the art that changes may be made in this embodiment without departing from the principles and spirit of the invention, the scope of which is defined in the claims and their equivalents.

[Effect of the Invention]

As described above, according to the present invention, video is adaptively encoded according to whether the video has the camera parameters and whether the camera parameters are reliable, thereby increasing the efficiency of video compression. Also, intermediate-view frames are adaptively generated according to camera parameter information included in an input bitstream, thereby improving the quality of video to be displayed.